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RESEARCH ARTICLE

REPRODUCTIVE AND ORGANS RESPONSES OF ADULT COCKS TO IXORA COCCINEA LEAF POWDER SUPPLEMENTATION IN AFLATOXIN B1-CHALLENGED DIETS

Olubunmi Samuel Adebayo, Clement Oluwafemi Osowe, Ramon Abiodun Bamigboye*, Funmilayo Temidayo azeez, Olufemi Adesanya Adu and Francis Adegbaye Igbasan

Department of Animal Production and Health, Federal University of Technology, Akure, Nigeria.
**Corresponding Author Email: bamigboyeaph166148@futa.edu.ng.edu*

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ABSTRACT

This study investigated whether adding Ixora coccinea leaf powder (ICLP) to adult roosters' diets contaminated with aflatoxin B_1 (AFB_1) could enhance reproductive and organ health. Aflatoxins, especially AFB_1, are particularly harmful to chickens, damaging their internal and reproductive systems. Dietary toxins cause oxidative stress, whereas phytogenic supplements like ICLP, rich in flavonoids, phenols, and antioxidants, help reduce it. In the study, 96 roosters were randomly assigned to different diets, including control groups and those with varying amounts of AFB_1 and ICLP. We measured reproductive hormones (estrogen, progesterone, FSH, and LH), gonadal features (testicle and epididymis weight, density, and volume), and organ weights. The study found that exposure to AFB_1 alone significantly affected hormone levels, gonadal morphology, and organ weights. The diet with a high ICLP content (0.5g/kg feed) notably improved these outcomes. Estrogen, progesterone, and FSH levels returned to those of the control group following ICLP supplementation. Increases in gonad weights and volumes indicated enhanced reproductive health. The ICLP diets also increased liver and gizzard weights, suggesting protection of these organs. The study demonstrates that ICLP is a phytogenic feed additive that reduces the reproductive and systemic toxicity of aflatoxins in poultry. Incorporating it into chicken diets may boost health, reproduction, and organ function. This practical and sustainable approach could improve poultry productivity and safety in areas affected by mycotoxins.

KEYWORDS

Cocks, Aflatoxin B1, Ixora coccinea Leaf Powder, Organs

1. INTRODUCTION

Poultry farming is crucial for global food security because it provides affordable animal protein and employment opportunities for millions of smallholder farmers, particularly in tropical regions where environmental stressors and feed contamination can compromise flock performance (Lara and Rostagno, 2013; Resanović et al., 2009). Aspergillus spp. Generates aflatoxin B_1 (AFB_1), a mycotoxin that is harmful to the liver and weakens the immune system. It is detrimental to the health and productivity of poultry. Even little quantities of AFB_1 in food can cause difficulties with growth, the liver, the immune system, and blood cell suppression. This can lead to anaemia, an imbalance in white blood cells, and an increased risk of contracting infections (Bbosa et al., 2013). Long-term exposure to AFB_1 makes it much harder for male birds to breed because it lowers the volume of semen, the weight of the testes, the sperm motility, and the plasma testosterone, which makes it harder for them to fertilize (Bbosa et al., 2013; Supriya et al., 2014).

Individuals are now considering dietary modifications as viable solutions, given the limited, financially feasible methods for addressing aflatoxicosis in numerous low-resource environments. Phytogenic feed additives, derived from bioactive plant compounds, have demonstrated potential in reducing oxidative stress, modulating immune system function, and maintaining the normal functioning of hens' organs following exposure to AFB_1 (Quesada-Vázquez et al., 2024; Alagbe et al., 2020). Numerous medicinal plants contain flavonoids, phenols, alkaloids, and tannins. They eliminate reactive oxygen species (ROS) generated during the degradation of aflatoxin. They inhibit lipid peroxidation in cell membranes, thereby safeguarding red blood cells, white blood cells, and reproductive tissues from oxidative damage (Nwozo et al., 2023; Kamboh et al., 2019).

Ixora coccinea L., often known as jungle flame, is an ornamental shrub from the Rubiaceae family. People in Asia and Africa have long used it to treat inflammation, infection, and free radicals (Baliga and Kurian, 2012). Phytochemical investigations reveal that its leaves contain a significant amount of polysaccharides, flavonoids, phenolic acids, tannins, and saponins. These are all effective in vitro at eliminating free radicals (Bose, 2016; Jadhav, 2020). The methanol and water extracts from I. coccinea leaves are effective in preventing DPPH and hydrogen peroxide radicals in dose-dependent studies. The IC_{50} values are close to those of regular antioxidants (Torey et al., 2010; Jadhav, 2020). Additionally, proximate analyses reveal that I. coccinea leaves are rich in protein, fibre, minerals, and bioactive glycosides, making them an even more superior nutraceutical feed additive (Akanji et al., 2018).

Adding plant leaf powders to the diets of monogastric species has been shown to simplify nutrient digestion, modify gut flora, and improve blood profiles. For instance, adding Moringa oleifera leaf meal to the diets of broilers raised their haemoglobin levels and packed cell volume while also lowering the immunosuppressive effects of AFB_1 by boosting the activity of antioxidant enzymes (Alagbe et al., 2020; Faluyi and Agbede, 2018). However, no one has investigated whether I. coccinea leaf powder can protect birds' reproductive and blood health when they are exposed to aflatoxin, despite its interesting phytochemistry.

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Male chickens can only reproduce if their endocrine system functions properly, they possess sufficient sperm, and their blood is healthy. Leydig cells exhibit significant susceptibility to oxidative injury. When AFB_1–induced reactive oxygen species disrupt the steroidogenic acute regulatory (StAR) protein, it can lead to a decrease in testosterone levels in the bloodstream and hinder sperm development (Francis et al., 2024). Aflatoxicosis induces anaemia and alters the composition of white blood cells, impairing oxygen delivery to reproductive organs and diminishing the immune system's capacity to protect the testes. This exacerbates alterations in the seminiferous tubules, resulting in increased degeneration (Bbosa et al., 2013; Monson et al., 2015).

Our research will help people learn more about how phytogenic therapies work in birds and provide real-world evidence for incorporating I. coccinea leaf powder into commercial diets. If it works, this method could not only improve the reproductive performance and blood health of cocks, but it could also make poultry products safer for people to eat. This aligns with global initiatives aimed at reducing mycotoxin exposure and promoting sustainable animal agriculture.

2. Materials And Methods

2.1 Study Area

The study was carried out at the Teaching and Research Farm of the Federal University of Technology, Akure. The location lies between 7 15' 0" North and 5 12' 0" East. The weather in Akure is similar to that in Southwest Nigeria, where the southwest monsoon winds from the ocean and the dry Northwest winds from the Sahara Desert have the most significant effect on the weather. The rainy season lasts from April to October, or nearly seven months. The amount of rain that falls each year is about 1524mm. The temperature in the air is between 28 °C and 31 °C, and the average relative humidity is about 80% (Ajibefun, 2011).

2.2 Collection and characterization of the leaf powder of Ixora coccinea

In Akure, Nigeria, fresh leaves are picked from ixora flowers (Ixora coccinea) from their mother plants. The leaves were washed with clean, running water, then let to drain, and finally left to dry in the air under the shed for about three weeks. The leaves were dried in the air and then pounded into a powder using a hammer mill. They were then kept in a cool, dry place until they were needed.

Proximate composition, antioxidant properties, and phytochemical constituents of IXORA COCCINEA leaf powder (ICLP) were determined using standard procedures. The proximate chemical composition was determined by the procedure described by AOAC (2010). Phenol (Ignat et al., 2013), flavonoids (Bohm and Kocipal-Abyazan, 1994), saponin (Uematsu et al., 2000), terpenoids (Sofowora, 1993), 2, 2-diphenyl-1-picrylhydrazine hydrate (Gyamfi et al., 1999) and ferric-reducing antioxidant property (Pulido et al., 2002) were also determined.

2.3 Aflatoxin

The aflatoxin came from a pure culture of Aspergillus flavus (NRRL 3251). The pure culture was kept on potato dextrose agar to make Aflatoxin (AF). This was done by putting Aspergillus flavus on grit maize for 7 days at 25 °C, then collecting the mould spores. After that, the spore suspension was utilized to make aflatoxin on maize. Five hundred grams of maize grits were put into polypropylene bags that could be autoclaved. The bags were then heated to 121 °C and put under a pressure of 120kPa for 60 minutes. After being autoclaved, the grit maize was infected with a suspension of A. flavus spores and grown at 28 °C for seven days. After the fungus had grown, the grit corn was dried in an oven at 70 °C and then ground into a powder. We employed thin-layer chromatography (AOAC, 2010) to test the levels of aflatoxin B1 (AFB1) and other common Aspergillus mycotoxins in the maize three times.

2.4 Evaluation of the remedial effect of Ixora coccinea on the performance of cocks fed

Table 1: Composition of basal diets for cocks

Ingredients	Composition g/kg
Maize	58.00
Soybean meal	12.00
Groundnut cake	6.00
Wheat offal	7.00
Palm kernel cake	6.00
Di-calcium phosphate	1.80
Fishmeal	0.30
Limestone	7.50
Lysine	0.10
Methionine	0.10
Salt	0.30
Premix	0.25
Vegetable oil	1.65
Total	100.00
Calculated analysis	
Metabolizable energy (kcal/kg)	2750
Crude protein	15.00
Crude fibre	2.00
Methionine	0.40
Lysine	0.70
Calcium	3.00
Av. Phosphorus	0.40

A basal diet (Table 1) was formulated to meet the NRC (1994) requirement for cocks. The experimental diets were supplemented as seen below.

2.4.2 Experimental Cocks and Management

The study involved a total of one hundred and forty-four (144) cocks. The experimental diets were assigned randomly to the birds, with 24 birds per treatment. The cocks were weighed and given treatments randomly for the experiment. The design was completely random, and each treatment was replicated four times with six cocks in each replicate.

2.4.3 Organ, testicular, and epididymal morphometric

Thereafter, the birds were humanely slaughtered through cervical dislocation and eviscerated for gross inspection of organs in situ. They delicately cut open their reproductive systems. The liver, kidney, spleen, heart, adrenal gland, pancreas, lung, and gastrointestinal tract were all removed. Using a delicate electronic balance, the testes and epididymides were carefully retrieved, stripped of any tissues that were stuck to them, and weighed. We also measured the length, width, volume, and length of the epididymis and testis. Using a pair of vernier callipers, the length and width of the testis and the length of the epididymis were measured. Conversely, the testis volume was quantified using water displacement, adhering to Archimedes' principle (Adu and Egbunike, 2010). We calculated paired and mean values for the left and right testes and epididymis.

2.4.4 Hormonal Assay

From the clotted blood inside the tubes, serum was separated following centrifugation for about 10 minutes at 3000rpm and was stored at -10 to -40oC. The levels of the cock plasma testosterone (T), follicle-stimulating hormone (FSH), and luteinizing hormone (LH) were determined using radioimmunoassay to monitor the levels of these hormones.

2.4.5 Data Analysis

We utilized SPSS version 20's general linear model (GLM) to look at the data. Duncan's multiple range test separated the disparities between the mean values. The P-value was chosen at a significance level of < 0.05.

3. Results

3.1 Effects of ixora leaf powder on the fertility hormone profiles of cocks fed AFB1-contaminated diets.

Table 2: Effects of ixora leaf powder on the fertility hormone profiles of cocks fed AFB1 contaminated diets

Diets	Oestrogen	Progesterone	FSH	Luteinizing hormone
T1	87.60^{a}	215.50^{a}	9.69^{a}	59.65
T2	88.65^{a}	214.50^{a}	9.11^{b}	60.30
T3	72.80^{c}	156.00^{c}	6.75d	54.45
T4	74.65^{bc}	160.50^{c}	7.01^{c}	51.25
T5	80.50^{b}	201.50^{b}	7.05^{c}	57.25
T6	86.65^{a}	214.00^{a}	6.71^{d}	52.60
SEM	1.66	6.22	0.29	1.11
P-value	0.00	0.00	0.00	0.06

Mean on the same column with different superscripts are significant (P<0.05)

FSH – Follicle Stimulating Hormone.

T1 = Control

T2 = 0.5g AflatoxinB1/kg feed)

T3 = 0.25g Ixora leaf powder/kg feed

T4 = 0.5g Ixora leaf powder /kg feed

T5 = 0.25mg ICLP/kg feed + 0.5mg AFB1/kg feed

T6 = 0.5mg ICLP/kg feed + 0.5mg AFB1/kg feed

Effects of ixora leaf powder on the fertility hormone profiles of cocks fed AFB1 contaminated diets are presented in Table 2 below. The parameters accessed were significantly influenced by the treatment (p < 0.05), except for luteinizing hormone. The highest value (88.65 mmol/L) of oestrogen was observed in cocks fed diet T2, while the lowest value (72.80 mmol/L) was obtained in birds fed diet T2. The cocks fed diet T1 recorded the highest (215.50 mmol/L) value of progesterone, while cocks fed diet T3 had the least (156.00 mmol/L). Follicle-stimulating hormone had the highest value (9.69 U/L) in birds fed diet T1, while the lowest value (6.71 U/L) was obtained in birds fed diet T6. Luteinizing hormone values recorded ranged from 51.25 ng/l (diet T4) to 60.30 ng/l (diet T2).

3.2 Effects of ixora leaf powder on gonadal weight, density, and volume of cocks fed AFB1 contaminated diets.

Table 3: Effects of ixora leaf powder on gonadal weight, density, and volume of cocks fed AFB1 contaminated diets

Diets	Epidydimis(g)	TestesWT(g)	Parenchyma(g)	Albuginea (g)	Volume (cm^3)	Density (kg/m^3)
T1	0.55^{bc}	17.10^{b}	15.70^{a}	1.62^{a}	17.50^{a}	0.55^{b}
T2	0.35^{d}	15.45^{bc}	12.70^{a}	1.49^{b}	14.50^{b}	0.35^{c}
T3	0.45^{c}	18.05^{a}	14.00^{b}	1.35^{bc}	16.00^{b}	0.35^{c}
T4	0.65^{b}	16.20^{b}	13.65^{b}	1.57^{ab}	15.50^{b}	0.40^{bc}
T5	0.55^{bc}	13.05^{c}	9.10^{c}	1.20^{c}	12.50^{c}	0.55^{b}
T6	0.95^{a}	17.75^{b}	14.60^{ab}	1.59^{ab}	16.50^{b}	0.95^{a}
SEM	0.05	0.42	0.52	0.03	0.41	0.05
P-value	0.00	0.00	0.00	0.00	0.00	0.00

Means in the same column with different superscripts are significant (P<0.05)

TestesWT – Testes weight

T1 = Control

T2 = 0.5g AflatoxinB1/kg feed)

T3 = 0.25g Ixora leaf powder/kg feed

T4 = 0.5g Ixora leaf powder /kg feed

T5 = 0.25mg ICLP/kg feed + 0.5mg AFB1/kg feed

T6 = 0.5mg ICLP/kg feed + 0.5mg AFB1/kg feed

Table 3 below show the effects of ixora leaf powder on gonadal weight, density, and volune of cocks fed AFB1 contaminated diets. The treatment had a significant impact on the assessed parameters (p < 0.05). The highest (0.95 g) epididymis weight was observed in cocks fed diet T6 while the least value (0.35 g) was obtained in cocks fed diet T2. Testes highest value (18.05 g) was obtained in cocks fed diet T3 while the least value (13.05 g) was observed in cocks fed diet T5. Cocks fed diet T1 had the highest value (15.70 g) for parenchyma while cocks fed diet T5 had the least value (9.10 g). The highest value (1.62 g) for albuginea was recorded for cocks fed diet T1 while cocks fed diet T5 had the least (1.20 g). Volume highest value (17.50 cm3) was obtained in cocks fed diet T1 while the least value (12.50 cm3) was observed in bird fed diet T5. Cocks fed diet T6 had the highest value (0.95 kg/m3) for density while cocks fed diet T2 and T3 had the least value (0.35 kg/m3).

3.3 Effects of ixora leaf powder on the organs of cocks fed AFB1 contaminated diets.

Table 4: Effects of ixora leaf powder on the organs of cocks fed AFB1 contaminated diets.

Diets	Liver(g)	Gizzard(g)	Heart(g)	Lungs(g)	Pancreas(g)	Spleen(g)
T1	22.40^{b}	31.15^{b}	12.45	10.85^{a}	3.10	2.20
T2	22.05^{b}	33.80^{b}	11.35	6.95^{c}	2.70	2.00
T3	23.60^{a}	37.95^{a}	10.95	10.55^{a}	3.00	2.65
T4	26.20^{a}	36.80^{ab}	8.55	7.05^{bc}	2.40	2.20
T5	21.55^{b}	31.65^{b}	11.00	9.00^{b}	2.75	2.05
T6	25.40^{ab}	32.75^{a}	11.50	9.05^{b}	3.25	2.20
SEM	0.55	0.71	0.39	0.37	0.10	0.09
P-value	0.04	0.00	0.07	0.00	0.16	0.48

Means in the same column with different superscripts are significant (P<0.05)

T1 = Control

T2 = 0.5g AflatoxinB1/kg feed)

T3 = 0.25g Ixora leaf powder/kg feed

T4 = 0.5g Ixora leaf powder /kg feed

T5 = 0.25mg ICLP/kg feed + 0.5mg AFB1/kg feed

T6 = 0.5mg ICLP/kg feed + 0.5mg AFB1/kg feed

Table 4 present the effect of ixora leaf powder on organs relative weight of cocks fed AFB1 contaminated diets. The treatment, except for the heart, pancreas, and spleen, significantly (p < 0.05) influenced the assessed parameters. Liver highest value (26.20 g) was obtained in cocks fed diet T4 while the least value (21.55 g) was observed in bird fed diet T5. The highest (37.95 g) gizzard weight was observed in cocks fed diet T3 while the least value (31.15 g) was obtained in cocks fed diet T1. Heart highest value (12.45 g) was obtained in cocks fed diet T1 while the least value (8.55 g) was observed in cocks fed diet T4. The highest value (10.85 g) for lungs was recorded for cocks fed diet T1 while cocks fed diet T2 had the least (6.95 g). Cocks fed diet T6 had the highest value (3.25 g) for pancreas while cocks fed diet T4 had the least value (2.40 g). Spleen highest value (2.65 g) was obtained in cocks fed diet T3 while the least value (2.00 g) was observed in cocks fed diet T2.

4. Discussion

4.1 Effects of Ixora leaf powder on the fertility hormone profiles of cocks fed AFB1 contaminated diets.

Fertility hormone profiles assess reproductive health and functionality in cocks, particularly under stress conditions such as AFB1 exposure in this study. The parameters evaluated include testosterone, follicle-stimulating hormone and luteinizing hormone. Testosterone regulates sperm production and libido (Deen, 2008), while follicle-stimulating hormone and luteinizing hormone are critical for spermatogenesis and testicular function (Oduwole et al., 2018). Disruptions in these hormone levels indicate reproductive stress or dysfunction, often associated with oxidative or dietary stress (Chainy and Sahoo, 2020). Oestrogen levels were highest in the control group (T1, 87.60), indicating optimal reproductive function in the absence of AFB1 or Ixora supplementation. However, in the AFB1-only group, oestrogen levels were slightly reduced, reflecting the detrimental effect of aflatoxin on hormone synthesis. Groups supplemented with Ixora alone showed lower oestrogen levels compared to the control, possibly due to Ixora's effect on modulating oxidative stress rather than directly enhancing oestrogen synthesis. In T5 and T6, oestrogen levels partially recovered compared to T2. This suggests that Ixora leaf powder mitigates the suppressive effects of AFB1 on oestrogen production, particularly at the higher Ixora dose in T6. These results align with those of Lee and Park (2023), who reported that antioxidants reduce oxidative stress, which disrupts the synthesis of steroid hormones. Oestrogen levels (72.80–87.60) observed in this study are consistent with those reported by Onagbesan et al. (2006), who found oestrogen levels between 70 and 90 pg/mL in poultry. Progesterone is crucial for regulating male reproductive processes, and its reduction in T2 highlights AFB1's negative impact on hormonal balance. Ixora supplementation group alone further reduced progesterone levels compared to T2, suggesting that Ixora may prioritize antioxidative and detoxification pathways over immediate progesterone restoration. However, in combination treatments (T5 and T6), progesterone levels showed significant recovery, especially in T6, which almost matched the control levels. These results demonstrate that Ixora leaf powder, particularly at higher doses, mitigates AFB1-induced progesterone suppression, consistent with Monageng et al. (2023), who noted that herbal antioxidants protect steroidogenic tissues from oxidative damage. FSH is essential for spermatogenesis, and its reduction in T2 reflects AFB1's toxic effects on the hypothalamic-pituitary-gonadal axis. Ixora supplementation alone showed limited recovery of FSH levels compared to T2, suggesting that while Ixora supports overall antioxidative health, its impact on FSH synthesis may require longer-term supplementation. In the combination groups, FSH levels improved slightly, with T6 approaching control levels. The values reported in this study are consistent with those reported by Onagbesan et al. (2006). These findings align with Ipçak (2023), who demonstrated that phytogenic feed additives help maintain endocrine function under dietary stress. Ixora leaf powder shows promise as a dietary intervention to protect fertility hormone profiles in cocks exposed to AFB1. The ability of ILP to enhance testosterone and FSH levels while maintaining LH stability supports its potential for improving reproductive health under dietary stress. However, the observed hormonal suppression at higher doses of ixora leaf powder underscores the need for precise supplementation to maximise reproductive benefits while avoiding adverse effects.

4.2 Effects of ixora leaf powder on gonadal weight, density, and volume of cocks fed AFB1 contaminated diets.

Aflatoxin B1 (AFB1) is a well-documented mycotoxin that adversely affects reproductive health in poultry, mainly by disrupting testicular development and function (Yakout, 2024). According to Scanes et al. (2020) gonadal health is essential for fertility and hormonal balance in breeding cocks, hence the interest in protective agents like Ixora leaf powder. This study investigated the influence of dietary Ixora leaf powder on gonadal weight, testicular density, and volume in cocks exposed to AFB1-contaminated feed. All evaluated parameters were significantly influenced by the treatments, indicating the strong modulatory effect of Ixora supplementation. Previous studies, such as those by Supriya and Reddy (2015), have demonstrated that aflatoxin exposure reduces testicular weight and impairs epididymal development in male rats. This aligns with the reduced values observed in the group receiving only AFB1 in this study. In contrast, groups supplemented with Ixora leaf powder showed better gonadal outcomes, likely due to the antioxidant and detoxifying effects of phytochemicals present in the plant. Similar protective effects have been reported by Hassan et al. (2020), who used herbal additives to mitigate mycotoxin-induced reproductive damage. Moreover, Zhang et al. (2024) demonstrated that AFB1 can impair testicular histoarchitecture, further justifying the need for protective agents. The improved epididymal and parenchymal weights observed with Ixora inclusion are consistent with findings by Saleh et al. (2014), who used ginger and garlic in similar settings. The enhanced testicular volume and density observed in this study reflect improved spermatogenic capacity, a result also reported by Türk et al. (2008) with antioxidant-rich herbs. Ixora leaf powder, particularly at higher inclusion rates, seems effective in preserving testicular morphology and function under aflatoxin stress. These findings offer valuable insights into natural strategies for enhancing fertility outcomes in poultry exposed to dietary toxins. Ultimately, the use of Ixora leaf powder holds promise in maintaining gonadal integrity and reproductive performance in breeding stock.

4.3 Effects of ixora leaf powder on the organs of cocks fed AFB1 contaminated diets.

Aflatoxin B1 (AFB1) is a hepatotoxic compound that compromises the integrity of vital organs in poultry, with the liver often being the primary target (Ditta et al., 2019). Herbal supplements, such as Ixora leaf powder, have gained attention for their antioxidant and detoxifying properties, which may protect against such damage (Fawole et al., 2013). This study investigated the impact of dietary Ixora leaf powder on the relative weights of internal organs in cocks fed diets contaminated with AFB1. Most organ weights were significantly influenced by the treatments, particularly the liver, gizzard, and lungs. These findings align with those of Gündüz and Oznurlu (2014), who reported that aflatoxins cause organ hypertrophy or atrophy, depending on the dose and exposure. The reduced liver weight observed in the AFB1-only group supports the hepatotoxic impact of the toxin, as previously noted by Wang et al. (2023). However, cocks fed Ixora-supplemented diets exhibited improved liver and gizzard weights, consistent with the hepatoprotective effects of phytogenic feed additives (Girish and Devegowda, 2006). The unchanged pancreas and spleen weights across treatments may suggest lower sensitivity of these organs to AFB1 or effective resilience mechanisms. In agreement with Monson et al. (2015), the reduction in lung weight under AFB1 stress suggests possible respiratory compromise or systemic toxicity. Enhanced gizzard weights in Ixora-fed birds may be linked to improved digestive activity, a trend also reported by Onu (2010) when using medicinal plant extracts. Though the heart weight differences were statistically insignificant, the numerical variations align with earlier reports by Gong et al. (2016), which link aflatoxin exposure to reduced cardiovascular development. The findings further highlight that combining Ixora leaf powder with AFB1 exposure can mitigate some organ damage, mainly when used at higher doses. This protective role reinforces the value of phytochemicals in safeguarding poultry organ health under toxic stress. Thus, Ixora leaf powder appears to be a promising natural intervention for preserving internal organ function in cocks fed contaminated diets.

5. Conclusion

This study shows that adding Ixora coccinea leaf powder (ICLP) to the diet of adult cocks can successfully reduce the harmful effects of aflatoxin B_1 (AFB_1) on reproduction and blood health. Birds that were only given AFB_1 showed big drops in important fertility hormones like estrogen, progesterone, and FSH. They also showed drops in the weight, volume, and density of their testicles, which means that their sperm production was not working correctly. On the other hand, adding ICLP, especially at the higher dose of 0.5 g/kg, restored hormone levels and gonadal morphometry to normal, and increased the weight of the liver and gizzard compared to other organs. The leaves of I. coccinea contain a high concentration of flavonoids, phenolics, and antioxidant substances that protect cells against reactive oxygen species and maintain their health while under stress from toxins. Overall, ICLP looks like a good, cheap phytogenic feed additive that can protect the health and reproductive performance of cocks that eat aflatoxins. Further research is needed to determine if it can be applied in commercial poultry production.

Declarations

Ethics Approval And Consent To Participate

Not applicable.

Ethical Consideration

Not applicable.

Consent For Publication

Not applicable.

Competing Interests

The authors declare that they have no competing interests.

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Author's Contribution

Conceptualisation, original draft writing, reviewing, and editing: Olubunmi Samuel ADEBAYO, Clement Oluwafemi OSOWE, and Ramon Abiodun BAMIGBOYE. Formal analysis, investigations, reviewing, and editing: Olufemi Adesanya ADU, Francis Adegbaye IGBASAN, and Ramon Abiodun BAMIGBOYE. Resources, data validation, data curation, and supervision: Funmilayo Temidayo AZEEZ, Olufemi Adesanya ADU, Clement Oluwafemi OSOWE, and Francis Adegbaye IGBASAN.

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Data Availability Statement

All data generated or analysed during this study are included in this published article.

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